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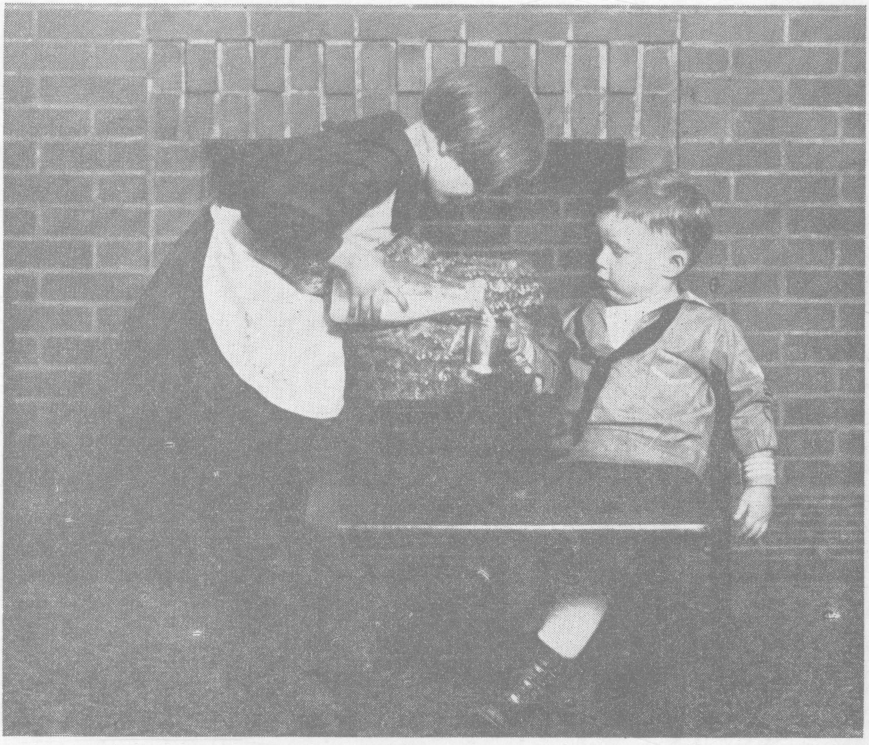
MILK: Its Importance as Food



Children find in milk those chemical substances which they need to develop strong healthy bodies.

THE OHIO STATE UNIVERSITY, COOPERATING WITH THE U. S. DEPARTMENT OF AGRICULTURE,
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Milk: Its Importance as Food

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NO nation has greater or better food resources than does the United States. There is a surplus of food so that comparatively few Americans suffer because of an insufficient amount. There is increasing evidence, however, that a great amount of under-nutrition exists in this country. A study of food conditions has led to the discovery of a most surprising fact, namely, that the poor, excepting the destitute, are better nourished than are the rich. The mere fact that a person eats *enough* food does not insure good health. He must be careful as well to select those foods that have the quality *properly* to nourish his body and protect it against disintegration and disease.

THE COMPOSITION OF MILK

Milk is Nature's answer to the question, what is the best food for the young? Obviously milk must contain everything required for the maintenance of health and for growth. In other words, it is a complete ration. In one respect only do we find milk falling short in meeting the requirements of a perfect food for the young: the amount of iron is too small to provide for rapid blood formation. Nature has taken care of this difficulty by giving to each new born child, calf, or other mammal a surplus of iron stored in the liver. This iron that is in the liver at birth is gradually used for blood building purposes, until at weaning time the store is practically exhausted, and from then on the animal has to depend entirely on the food for iron. If an adult lives on milk alone, or if a child is nursed beyond the normal weaning time with no additional food, a serious anemic condition will develop sooner or later. Aside from this deficiency in iron, milk contains everything needed by the young for perfect nutrition. The amount of fat in the milk of different breeds of cattle varies greatly; but the other constituents, excepting water, are about the same in all breeds.

Composition of Milk from Various Species

Species	Water	Protein	Fat	Sugar	Ash
Human	88.5%	1.5%	3.3%	6.5%	.2%
Cow	87.9	3.3	3.6	4.5	.7
Goat	89.2	2.8	3 4	3.8	.8

According to the above table, milk contains only five substances. Actually milk is much more complex, containing a large number of

compounds, most of them in very small amounts. What we call ash is made up of a complex mixture from which calcium, phosphorus, magnesium, potassium, sodium, chlorine, sulfur, iron, and traces of other elements can be separated. Then there are in milk traces of organic compounds which are not included in the ordinary analysis. Such are the vitamins, of which five, called A, B, C, D and E, have been identified.

In practical dietetics, the excellent food value of milk depends on the ash or minerals and vitamins as much as it does on its other constituents. Protein, fat, sugar, and starches are common and abundant in practically all American diets. In these prosperous days we are drunk with their excess; but people are starving or half starving in America and Europe for vitamins and minerals.

Milk an Inexpensive and Excellent Body Building Food

Protein Foods Necessary for Growth.—Sugar, starch, and fat are excellent *fuel* foods, but are *not* suitable for the *repair* of waste or the *growth* of new body substance. The reason for this is evident. The active parts of the body, the muscles and organs, are composed not of sugar, starch, or fat, but of another substance known as protein. Protein likewise is the chief constituent of the white of the egg and of blood. Protein food, then, must be fed liberally in order that young animals may grow rapidly and that both young and old may maintain strong, healthy bodies.

Mineral Salts Serve Dual Purpose in Body.—Besides protein, certain minerals are also required for repair and for constructive purposes. For example, the bones consist largely of phosphate of lime, and minerals are present in all tissues of the body as a constituent part. The minerals required in largest amounts are sodium chloride or common salt, lime, potash, magnesia, iron, phosphorus, and sulfur, with traces of others, such as iodine and manganese. The minerals serve a dual purpose in that they are required for repair and growth and also are necessary as lubricants, so to speak, which help to regulate the body processes and to keep all parts in good working condition. A good supply of these salts in the food is absolutely necessary for normal growth and for the maintenance of health.

Milk Supplies Both Protein and Minerals.—Milk is the best food for growth and for repair of tissues because it contains large quantities of protein and salts required in these processes. In fact, there is no other food which contains both protein and all the salts in sufficient amounts to meet the needs of the body.

The only deficiency of milk known is in respect to iron. This mineral is not abundant in milk, but the iron of milk appears to be used with great economy in the body so that the high quality of the iron compounds in milk partly makes up for the small amount present. Iron, however, is well supplied by cereals, fruits, and vegetables as well as by meat and eggs, so that on an ordinary diet a person would not suffer because of too little iron if these foods are used generously.

The protein of milk, meat, and eggs is of a superior quality, being very similar to the protein of the body, while the proteins found in cereals, beans, and vegetables is quite unlike body protein and of poor quality. Children can not grow properly on the proteins of cereals, beans, tubers, roots, and fruits. It is essential that they have a liberal allowance of milk protein. Adults, to be sure, may secure plenty of good protein from meat, but milk protein is as cheap or cheaper, and at the same time milk supplies the minerals needed which are lacking in meat.

A quart of milk contains a little more than 1 ounce of protein, approximately as much as there is in 6 ounces of meat or in 1 pound of bread. It is known that men can keep in good health and vigor when the daily diet supplies as little as 2 ounces of protein. A quart of milk a day practically meets the need of children under 6 years for protein, and supplies about half the minimum requirement of the adult. During the periods of infancy and childhood, milk protein is by far superior to that found in any other food. By all means milk should be fed liberally throughout this time in order that a strong, robust body may be developed.

A careful study of foods has revealed the fact that most of the common articles of diet are very low in lime. Meat, tubers, roots, most fruits, cereals, and beans all contain too little lime to meet the full requirements not only of children, but even of adults. A survey of conditions in many families has shown that a large proportion, probably at least one-fourth, of the people of the United States suffer impaired health and vigor because their daily food does not supply sufficient lime. Indeed, there is reason to believe that lime deficiency in the diet is more common than any other deficiency. Milk is exceptionally rich in lime. A pint of milk contains as much lime as 4½ pounds of bread, 12 pounds of meat, or 10 pounds of potatoes. Further, a pint of milk contains nearly as much lime as is required in a day by the average man. The lime requirement of growing children is relatively very high on account of the growth of bone and other tissues which is taking place. A quart of milk a day for every child and a pint a day for every adult in-

sures safety against a possible deficiency of lime, which might result in lowered vitality, disease, and an untimely end.

Besides lime, milk supplies the other minerals required, with the exception of common salt and iron. As a source of protein and minerals, then, milk in the diet in generous amounts assures safety in properly supplying the needs of the body for these repair and constructive materials essential for growth in the young and for the maintenance of health and strength throughout life.

Vitamins in Milk

Since 1912 a great interest has developed in these substances, and many experiments have been made in order to learn more about them. In 1912 an English experimenter found that young animals fed on a mixture of pure protein, fat, carbohydrate (starch or sugar), and minerals did not thrive; in fact, while they ate the food with relish, they appeared to starve to death. He made the interesting discovery that the addition of a very small amount of milk to the food mixture started the animals growing at the normal rate. He saw that milk must contain something besides protein, fat, carbohydrate, and minerals, something necessary for growth and the maintenance of health, but something unknown up to that time. This discovery is the most important one made in recent times in the subject of food chemistry. It gives us an entirely new conception of food values, enabling us to appreciate certain foods as we never could before and to understand the shortcomings of others.

Since 1912 five different vitamins have been discovered. These are named vitamin A, vitamin B, vitamin C, vitamin D, and vitamin E. The amounts of these substances which must be supplied by the food are extremely small, yet they are absolutely necessary for the proper digestion and absorption of food, for growth, and for the maintenance of health.

What Vitamins Supply.—When vitamin A is lacking, growth stops and health is impaired. Bacterial infections are likely to attack the eyes or the respiratory tract. In the absence of vitamin B, appetite fails, the digestive system is upset, the muscular and nervous systems become sluggish. There is a great loss of weight, ending finally in paralysis and death. When vitamin C is lacking a disease known as scurvy results. In scurvy the circulatory system is affected; the walls of the small blood vessels break down, causing hemorrhages into the muscles and the tissues between the joints. When vitamin D is lacking there is a failure of mineral matter to deposit properly in bones and teeth, resulting in a poor condition in those parts. Vitamin E, the fertility vitamin, is neces-

sary for the reproductive function. Raw milk from properly fed cows, allowed outdoor range, contains all these vitamins in well balanced proportions.

Vitamins may be divided into two groups: first, those that dissolve readily in water, and second, those that dissolve readily in fats and oils. The fat soluble group, which includes vitamins A, D, and E, are found mostly in cream and butter, while skim milk contains little of them. Vitamins B and C, on the other hand, are scarcely found at all in butter, but more abundantly in cream and milk.

Milk Too Expensive as a Fuel Food

Fuel must burn in order to give up its latent power or energy, so food is burned, or as we say oxidized, in the body. The oxygen absorbed from the air in the lungs takes a part in this burning or oxidation, and heat and muscular power are produced along with certain chemical products. The fuel value of coal, wood, sugar, fat, or any food can be measured easily. The unit used to measure fuel value is known as the calorie, and it represents a certain amount of heat, enough to raise the temperature of 1 pound of water 4° Fahrenheit. It is about as easy to measure fuel values with the calorie standard as it is to measure cloth by the yard or wheat by the bushel.

The amount of fuel food required by a person depends on the age, size, and activity of the individual. A child requires more in proportion to size than an adult, a large person more than a small one, and an active man more than one who is not working. If the food eaten does not supply enough fuel to meet the needs of the person, some of the material already in the body, principally fat, will be used up and there will be a loss in weight. If the food contains an excess of fuel there will be a storage of fat in the body with a gain in weight. One can tell, then, in a general way whether the diet is sufficient in fuel value by observing the body weight for a period of several weeks.

Milk is an expensive *fuel* food because the average man would require about 5 quarts of milk daily, if he ate nothing else, in order to do full work and maintain his weight. Bread, cereals, potatoes, sugar, and fats are much cheaper fuel foods, and hence we should rely chiefly on these substances for fuel. Milk has its great value as a food not because of its *fuel* value, but rather because of its ability to repair waste tissue, to supply material for growth, and to keep the bodily machinery in good working order and to keep it running smoothly.

As long as people have sufficient money to buy meat, potatoes, bread, butter, sugar, and lard, they will have plenty of protein, fats, sugars, and starches, and they will not grumble about hunger and starvation. Nevertheless if they buy nothing else they will be starving or half starving for certain minerals and vitamins without knowing that anything is wrong. Health will be below par and length of life will be uncertain. In these days of ready-to-eat groceries it takes brains and will power if one is to fill his market basket with the proper materials for a balanced ration.

Milk Heads List of "Protective" Foods.—The wise provider will learn to follow this rule: first, buy plenty of those *"protective"* foods that are rich in vitamins and minerals, such foods as milk, leafy vegetables, fruits, and root vegetables; second, with the money that is left buy enough meats, cereals, fats, and other wholesome food to satisfy hunger.

If there is plenty of money, about the only question to be considered in selecting food is in regard to its wholesomeness. Of course no unwholesome food should be used. If money must be made to go as far as possible the cheaper, but wholesome, articles can be substituted wholly or partly for the more expensive. Cabbage can serve instead of celery, common fruits and vegetables in season can be used instead of the more uncommon or out-of-season varieties. The use of bread and cereals can be increased and meat decreased, and other similar adjustments can be made to save money without any serious danger to health.

We can find many examples of cheap but excellent diets in use in various parts of the world, such as: potatoes and milk in Ireland; oatmeal and milk in Scotland; bread, milk, and potatoes in Germany, Denmark and the Scandinavian countries; bread, sour milk and greens in Armenia, Turkey and Bulgaria; bread or rice and greens in Italy, Greece, Egypt, India, China, and Japan. In all of these countries milk or greens or a combination of the two add certain vitamins and minerals to the cereal-root vegetable diet. In the United States, milk and green leafy vegetables both are used as protective foods; but many people use them in inadequate amounts for the full protection of health.

Value of a Balanced Diet.—Careful studies on the chemistry of foods and the chemistry of feeding have proved that strong, healthy boys and girls cannot be raised on diets lacking the proper kinds and amounts of minerals and vitamins. You might as well try to build a good strong house or barn without any nails or with only

one-half or one-third enough. If there were only one nail where there should be three we couldn't expect the building to be as strong and durable as it ought to be. Again, if the plan for a barn called for a building 40 by 60 feet, but there was only enough framing material for one 30 by 40 feet, the plans would have to be redrawn and a smaller barn built. With boys and girls a similar thing happens. If the food does not furnish enough framing material, the child is stunted in growth, more or less. The chemists have come to the conclusion that the main thought to be kept in mind when food is chosen is to make sure that everything required by the body shall be provided in abundance. Their experiments have convinced them that, for the people of the United States, milk and green leaves are the pillars on which the triumphal arch of good nourishment rests.

Milk Demonstration in Schools Shows Definite Results.—Miss Jessie M. Hoover, milk utilization specialist, United States Department of Agriculture, tells of a three months' milk demonstration in the schools of a mid-west city, which shows how plenty of milk makes school children grow. At the beginning of the demonstration the use of milk was low, only ¼ pint per day per person. After the demonstration this had increased to 0.43 pint, an increase of about 70 per cent.

Stories on the value of milk were told in all schools. In two schools making the best records, over half the underweight pupils made up their deficiencies in weight during the three months of increased milk drinking.

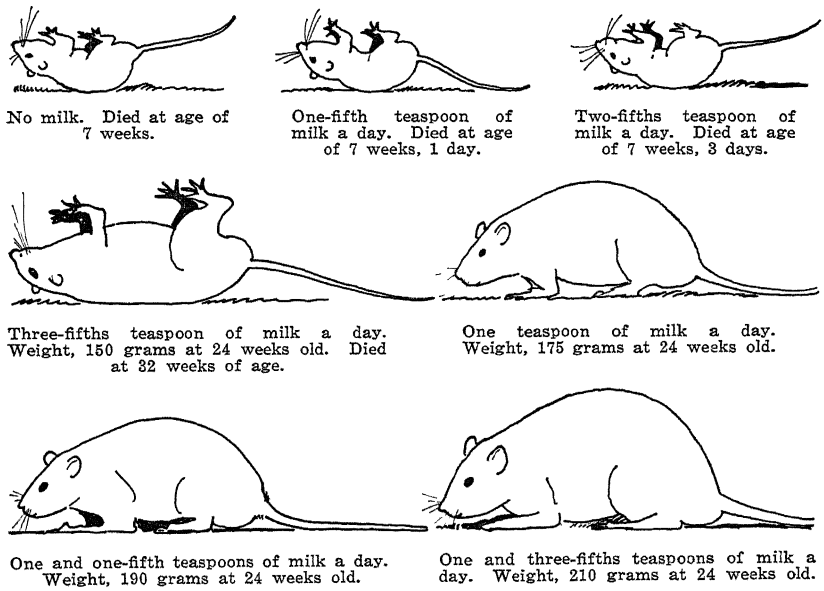
Results of Milk Demonstration

School	Percent of pupils 10% or more underweight at beginning	Percent of pupils 10% or more underweight after increased use of milk for three months
No. 1	40	25
No. 2	35	25
No. 3	28	18
No. 4	45	35
No. 5	30	14
No. 6	48	43
*No. 7	18.5	8.5

* The teachers of this school did not fully cooperate. Stories on the use of milk were told in the school by the specialists. The boys in this school often caddy for professional baseball players, including Walter Johnston and Babe Ruth. Perhaps the boys learned valuable facts about keeping physically fit from their associations with the athletes.

Experiments with White Rats Prove Milk Vital to Growth.—The following experiment with a family of nine white rats (seven males and two females) illustrates the power of milk to protect health and provide for the proper growth of large, strong bodies. This family was left with the mother until weaned at the age of 21 days. At that time they were separated into individual cages and each rat was given all it could eat of a food mixture consisting of wheat flour, dried lean beef, dried potatoes, butter, lard and salt. The proportions were about the same as they are in the average human diet. In addition to this mixture varying amounts of fresh milk were fed daily, as described under illustrations.

Plenty of Milk Is Best for Growing Animals



No milk. Died at age of 7 weeks.

One-fifth teaspoon of milk a day. Died at age of 7 weeks, 1 day.

Two-fifths teaspoon of milk a day. Died at age of 7 weeks, 3 days.

Three-fifths teaspoon of milk a day. Weight, 150 grams at 24 weeks old. Died at 32 weeks of age.

One teaspoon of milk a day. Weight, 175 grams at 24 weeks old.

One and one-fifth teaspoons of milk a day. Weight, 190 grams at 24 weeks old.

One and three-fifths teaspoons of milk a day. Weight, 210 grams at 24 weeks old.

The rate of growth and length of life were directly proportional to the amount of milk given. Besides this, there was also a difference in the physical appearance of the animals. Those that had little milk were unthrifty and miserable looking, while the rats that got the most milk were sleek and healthy. One female getting four-fifths of a spoonful of milk never raised any young; while the one getting one and two-fifths spoonfuls of milk raised two litters (these two omitted in illustration).

If the experiment had been tried on a family of boys and girls instead of white rats the results would probably have been the same, since rats resemble humans in food requirements.

Do We Use Sufficient Milk in the United States?

Dr. E. V. McCollum of Johns Hopkins University says: "It is unnecessary to dwell upon the specific nature of the deficiencies of each of our more important natural foods, but it may be said that in general there is a marked tendency of the diet of the average American today to be deficient in the element calcium, to be somewhat over-rich in phosphorus in proportion to the amount of calcium it contains, to be deficient in the vitamin A, and in some cases in the vitamin C, as well as in the antirachitic principle associated with certain fats, the vitamin D. Numerous experimental studies with animals have established the remarkable value of such supplementary foods as either milk or leaves."

As a people, Americans are not as well fed as they think. As evidence, note that medical examination shows malnutrition in approximately one-third of all school children in the United States. During our latest great war approximately one-third of our young men were found physically unfit for military duty, and over 21 per cent were disqualified for any kind of military service, even of the limited or unlimited class.

Build Strong Bodies by Proper Diet.—Spreading of the knowledge that plenty of milk is essential for proper growth, strength, and health in children and youths, has resulted in a considerable increase in the use of milk by the American people. The United States Department of Agriculture reports that the daily consumption of milk has increased from .94 pint per capita in 1920 to 1.21 pints in 1926. Daily consumption of milk and cream on farms in 1926 was found to be 1.47 pints per capita, and in cities .967 pint. Dr. H. C. Sherman of Columbia University says: "Certainly it seems to me the boy should have his quart of milk per day until he is a man full grown, and the girl should continue to take her quart of milk per day until as a woman she has weaned her last child."

Denmark, Switzerland, Sweden, Netherlands, Finland, and Norway produce more milk per capita than we do; while Germany produces nearly as much. The increased consumption of milk is very gratifying, and will have a powerful effect on healthful conditions in this country.

The interests of health could be advanced by a further increase in the use of milk. Dr. Sherman finds that the minimum amount of milk that can supply as much bone building calcium and phosphorus as are required by normally growing children is one quart a day. Each adult man should have at least one pint a day in order to insure a balanced diet, sufficiently rich in calcium and in other nutrients.

Milk as a Preventive of Disease.—It must be remembered that some individuals use much more milk than the average, while others use much less. Even though there is plenty of milk provided for a family to give each person his full quota, those who fail to get their share must suffer the consequences. Every family and every individual must provide and use the milk that is necessary for health protection, for in the end the use of food is a personal matter, and public health is not a matter of averages, but rather a matter of individual excellence.

There are said to be one million hospital beds constantly full in the United States. Probably one-third of the cases in these beds are gastro-intestinal cases of various kinds, practically all of which would be in good health had a proper diet been followed from childhood on. The dividing line between a food and a medicine sometimes becomes almost invisible. In many diseases nothing heals the body and restores strength like milk; but as a preventive, milk, taken in childhood and youth and continued throughout life, is a wonderful builder of strong, active, disease-resisting bodies.

Milk as Food for Infants

Obviously the most satisfactory food for infants is that provided by nature, mother's milk. Unfortunately many mothers find it impossible to nurse their babies and artificial feeding must be resorted to. For bottle-fed babies, cow's milk must be substituted for mother's milk and the tremendous importance of the dairy cow as the foster mother of mankind can not be overstated.

Cow's milk and human milk, while alike in a general way, are very different in certain respects. The principal differences are: (1) cow's milk contains about twice as much protein as does human milk, (2) cow's milk contains about three times as much mineral salts as human milk, (3) cow's milk contains less sugar than human milk, (4) cow's milk curdles in the stomach in large dense curds, human milk curdles in small flakes, (5) the fat droplets in human milk are smaller than in cow's milk. The total solids and percentage of fat in the two milks is about the same.

The infant during the first few months of life cannot digest cow's milk in its natural state because of these differences, hence cow's milk must be modified by dilution and otherwise in order that satisfactory results may be obtained. It is beyond the scope of this bulletin to attempt to give any specific directions for modifying milk for infant feeding. Such information may be obtained from a number of good books and bulletins on the subject, among which

the bulletin on Infant Care, published by the Children's Bureau of the United States Department of Labor, can be recommended.

Milk for Children

Every one admits that milk is indispensable for infants, but there is a rather general belief that after the first year milk is no longer necessary, or at least that the amount of milk can be greatly reduced with safety. This is a great mistake. During the period of childhood, growth should go on steadily and rapidly. In order to secure this, the food of the child must be easily digested and rich in growth-producing materials, proteins, mineral salts, and vitamins. Milk is the only article of food that meets these requirements; in fact, a combination of any other foods can not fully take the place of milk during this period of life.

Many children, because of poor nourishment during childhood, are so weakened in health and their physical development is so impaired that they never recover from the effects even though they live to manhood and womanhood. In many cases the cause of much suffering and misery among children is due to improper feeding, often not recognized as such. A quart of milk a day for each child is a good and a safe rule. Of course, milk should not be the only article of food, yet it should constitute the basis of the diet. It is the duty of the parents to provide the milk and see that the children drink it. Sometimes persuasion and argument are necessary to get an unwilling child to take the milk that is really good for him. Occasionally a child has an aversion to drinking milk that can not be overcome. In this case the mother should cook for the child as many dishes with milk as possible, and encourage the use of milk on cereals and fruits.

Plenty of milk in the diet during childhood is the best prescription that can be given for the child. Strong, sturdy bodies can not be developed on an improper diet, and food chemists are perfectly sure that milk is such a good food and so beneficial in its effects on children that every child in the land should have plenty of milk with every meal, every day in the year.

Milk for Adults

Every one admits that milk is indispensable for infants, many even agree that all children and growing boys and girls ought to have milk, but most people say that milk is not at all necessary for adults. Of course, adults can live without milk, but that is not the point. A horse or cow can *live* on straw and nothing else, but it is a miserable life for the animal. Many people who believe that they

eat the proper food and plenty of it are really poorly nourished and suffer much pain because of it. It is safe to say that practically all of these poorly nourished people use very little milk.

The standard diet of meat, potatoes, and bread, so common in the United States, is very low in lime and deficient in vitamins. Experts believe that a man cannot keep in the best physical condition on such a ration. A pint of milk a day makes good most of the deficiencies in the above diet, and at least that amount of milk ought to be used by every youth and adult. There are a few who can not take milk as a beverage for one reason or another. Such persons should use milk very liberally in cooked foods, for milk consumed in this way has practically the same food value as when taken as a beverage.

The Value of Milk in Maintaining a Healthy Condition in the Intestine

Bacteria are present in enormous numbers in the lower bowel of man. It has been estimated that one-third of the residue ejected from the intestine is made up of these organisms. Now these bacteria are of different types, some of them being practically harmless, others producing substances which are distinctly toxic. These toxic substances may be absorbed into the system and produce very harmful results, even permanent injury, to the individual harboring the bacteria.

The good effects of purgatives and laxatives, physics and pills, are due in large measure to their cleansing action on the intestine. The use of drugs in this way is of little permanent benefit. If the diet is unchanged the same kind of bacteria develop again and trouble returns. Stools having a very offensive odor are a sign of a bad condition in the large intestine. The stools of the breast-fed infant ordinarily are inoffensive. Bacteria in large numbers are present, to be sure, but they are of a type which do not produce large amounts of toxic substances. Milk is known to be beneficial in keeping out those harmful kinds of germs.

The generous use of milk, then, tends to improve the sanitary condition of the digestive tract and to control the growth of those harmful bacteria which are prone to develop when the diet consists of meat, potatoes, and white bread. The well known good effects of fruits and such vegetables as carrots, parsnips, and turnips, are probably due in large part to the effect which they have in developing a harmless race of bacteria in the intestine and thus keeping out the trouble makers. For the sake of good health, milk, fruits, and vegetables should be used freely. Milk, with many per-

sons has a constipating effect which is counteracted by fruits and vegetables, so the combination of foods is most desirable.

Buttermilk and sour milk are relished by many persons and sometimes digest more readily than fresh milk. If the milk is soured with a particular kind of bacteria, called *bacillus acidophilus,* there is an advantage in overcoming harmful bacteria that may be in the intestine, since the *acidophilus* organism is well adapted to living in the bowel when the diet contains plenty of milk, and its growth prevents the multiplication of other races of bacteria that might be harmful.

Milk as a Possible Carrier of Disease

Milk as it exists in the udder of the healthy cow is practically free from bacteria. In the process of milking more or less bacteria always get into the pail, depending on the cleanliness of the cows, stable, and milker. Milk, especially warm milk, is a favorable medium for the rapid multiplication of these bacteria, and unless precautions are taken milk sours rapidly because of the substances, principally lactic acid, produced in the milk by the bacteria. Usually the lactic acid producing bacteria are the principal ones in milk, but others are present also, some of which may produce strong, unpleasant odors and flavors.

Keeping the Product Free From Germs.—Disease germs occasionally get into milk, either directly from a diseased cow or indirectly from a sick person, from a polluted well, or in some similar way. The problem of supplying clean, sweet milk, free from disease germs, has been a very difficult one for our cities to solve. It is essential that all who handle milk should understand that care and cleanliness are required in keeping it pure and safe. Furthermore, it is important to remember that bacteria multiply rapidly in warm milk, but in cold milk the number of germs does not increase nearly so fast.

Benefits of Pasteurization.—Care, cleanliness, and cold are essential in producing and handling milk. Fortunately, disease germs are easily killed by heat, a temperature of 140° Fahrenheit continued for 20 minutes being sufficient to destroy all such germs in milk. Boiling, of course, destroys disease producing bacteria, but at the same time heating in this way changes the flavor of milk, giving it a cooked taste. Most of our larger cities now safeguard their milk supply by subjecting the milk to the pasteurization process, which consists in heating the milk to a temperature of 140° Fahrenheit, at which point it is held for about 20 minutes, or by

heating to a higher temperature for a shorter time and cooling quickly. Pasteurized milk, if properly handled after being pasteurized, is free from all danger and is not devitalized in any way except that vitamin C is destroyed more or less completely.

It is estimated that about 10 per cent of the cows of the United States are affected with bovine tuberculosis, and there may be danger, especially in infants, that human beings may become infected with this disease through the use of milk from tuberculous cows. It is wise, therefore, even on the farm to pasteurize all milk fed to infants. Diseased animals should not be tolerated and the milk from only healthy cows should be used as food. In all that is said in this bulletin concerning the food value of milk it is assumed that the milk is produced from healthy cows under sanitary conditions and that the product is properly handled from the time it is drawn until consumed.

The Use of Milk on the Farm

There are many farms where milk, though plentiful, seldom appears on the table. Anything that can be said regarding the food value of milk applies to its use on the farm as well as to its use in the city, and there is this fact in addition—milk costs the farmer about one-half as much as it costs the city man. No farmer can afford to neglect the free use of milk as a food for his family.

Milk is not only a substitute for meat, it is an improvement over meat. The free use of milk on the farm means reduced food bills; but more important than this, it means better health, greater capacity to work, and an increased joy in life. The farm housewife, at small expense, can use milk and cream freely in cooking, and insure a superior quality to the food on her table. Milk used in cooking gives full value in nourishing the family, and such use is a wise practice which should be extended rather than curtailed. In the majority of farm homes visited by the writer, milk does not appear regularly on the table as a drink. A pitcher of milk freely passed around and a glass at every place is the best health insurance a farmer can have. Whole milk is best, but skimmilk is excellent. We all know how well pigs and chickens thrive on milk—even skimmilk. It is certain that milk is as beneficial for man as for farm animals.

We use tea and coffee entirely for the pleasurable sensation given by the beverages. They have no food value aside from the sugar and cream used with them. In fact, tea and coffee become dele-

terious to health when consumed excessively, and are detrimental to children in any quantity. Milk as a beverage, on the contrary, has a high food value, insures good health, and in the long run gives greater pleasure than either tea or coffee.

Condensed Milk and Milk Powder

These products are concentrated milk, that is, milk from which more or less of the moisture has been removed by evaporation. Condensed milk has about double the food value and milk powder nearly eight times the food value of fresh milk. Milk powder, however, is usually prepared from skimmilk, hence its food value should be compared to skim rather than to whole milk. Condensed milk and milk powder are excellent foods. They have an important place in cookery. In the tropics and elsewhere when fresh milk is not available they can be used as substitutes for milk.

How Milk May be Used in the Day's Meals

When the chemistry of nutrition and physiology of digestion determine the needs of the body and the foods which will supply these needs, the food problem has not been disposed of. Preparation of such foods follows close on their heels and claims a position of importance. In our present state of civilization we demand freedom from monotony in the matter of foods as well as in our manner of amusement and dress.

Perhaps no other food lends itself to a greater variety of ways of preparation than does milk. As a drink, hot or cold, with or without the addition of accessories, milk serves not only as a beverage, but as a food. It is the basis of all cream soups, to which is added a little flour, mashed or strained vegetables. The quality of creamed, escalloped, and combination dishes is dependent upon a generous use of milk. Many cheese recipes are incomplete if this one food item is omitted. Gravies are varied by the use of milk. A long list of desserts, puddings, pies, ice-creams, and custards may be developed by using milk either as a basis or as a sauce. Cottage cheese, which was given a place in the limelight during the recent war, is a derivative of milk and serves well as a meat substitute. All of the cereals, in whatever way prepared, can be effectively supplemented by good, rich milk. Milk used in the making of bread gives it a higher food value as well as a better flavor.

It is possible to get a whole quart of milk into the day's food of each person without drinking it, but it requires careful planning and preparation.

MILK DISHES

ABBREVIATIONS

t—teaspoon
T—tablespoon
c—cup
qt.—quart

MILK AND BREAKFAST CEREALS

MILK ON CEREAL

Usually a half cup of whole milk may be used in this manner.

COOKING CEREALS IN MILK

Milk may be substituted for part of the liquid in cooking cereals. For instance:

CORN MEAL MUSH

1 c. corn meal
1 t. salt
2 c. milk
1½ c. boiling water

Mix meal with cold milk. Stir into boiling salted water and cook in double boiler an hour or more. Serve with cream or whole milk.

DELICIOUS MILK DRINKS—COLD

CHOCOLATE MILK SHAKE

1 T. cocoa paste.
1 c. milk

Add cocoa paste to cold milk in a shaker or pint jar. Shake well and serve immediately.

COCOA PASTE

1 c. cocoa
1 c. sugar
Few grains salt
2 c. water

Mix cocoa, salt and sugar in a double boiler. Add water and cook to a smooth paste. By cooking a long time (about 1 hour) a better flavor is obtained.

EGG NOG

1 egg
1 c. milk
1 t. sugar
Few drops vanilla or few grains of nutmeg
Few grains salt

Beat egg with sugar and salt. Add milk and flavoring. Serve cold.

MILK BLOSSOM

Add to cold milk, slowly, stirring constantly, any sweetened fruit juice such as cherry, strawberry, or raspberry. Use only enough fruit juice to flavor the milk. Serve immediately.

CLABBER (Soured Milk)

Chill good fresh soured milk, add a teaspoon of sugar and a few grains of nutmeg. Stir to break up the curd. Serve cold. A few drops of lemon juice are sometimes desirable.

DELICIOUS MILK DRINKS—HOT

HOT MILK

Many persons who do not like cold milk enjoy drinking heated milk. Simply heat until steam begins to rise. Serve at once.

COCOA

¼ c. milk — ⅛ t. salt
2 T. cocoa — 3 T. sugar — 1 c. water

Mix the cocoa, salt and sugar. Add water. Cook for 5 minutes, stirring to prevent burning. Add the milk and heat, but do not boil. Serve. Cocoa paste may be beaten into hot milk to make cocoa.

CREAMED DISHES

The basis for all creamed dishes is white sauce. These sauces or milk gravies should vary in thickness with the use to which they are put.

	Milk	Flour	Butter	Salt	Used for
Thin	1 c.	½ to 1 T.	1 T.	¼ t.	Cream soups, cream toast.
Medium	1 c	2 T.	1 to 2 T.	¼ t.	Cream vegetables, meat, fish, eggs, escalloped dishes, gravies.
Thick	1 c	3 to 4 T.	2 T.	¼ t.	Croquettes, some escalloped dishes.

Method.—Melt butter and blend with flour and salt. Add cool or slightly warm milk and cook until thick, stirring constantly (over direct fire, cook five or six minutes; in double boiler, cook 15 minutes to cook flour).

CREAM OF CARROT SOUP

2 c. carrot — 1 t. salt
2 t. onion (if desired) — 4 c. thin white sauce

Cook diced carrots and onion in boiling salted water until tender. Chop, grind, or rub through a coarse sieve and combine with white sauce. Serve hot. A stalk of celery or a sprig of dry celery leaves improves the flavor.

CREAM OF PEA, OR CORN, OR SPINACH SOUP

Substitute peas, or corn, or spinach which have been put through a coarse sieve or food grinder in place of the carrots. A few diced carrots floating add to the attractiveness of the dish.

CREAM OF SPINACH SOUP

4 c. thin white sauce — ½ t. salt
2 c. cooked spinach or other greens, chopped, ground, or rubbed through a coarse sieve.

Add hot greens to hot white sauce and serve on small triangles of crisp toast.

CREAM OF TOMATO SOUP

2 c. tomatoes — 4 c. thin white sauce
1 t. finely chopped onion if desired — 1 t. salt

Cook tomatoes with these ingredients about 5 minutes. Rub through a sieve and add ½ level teaspoon soda. Make 4 cups thin white sauce. Add hot strained tomato slowly to white sauce. Without further heating, serve. Do not combine tomatoes and white sauce until ready to serve.

POTATO SOUP

3 medium sized potatoes cut fine — 6 c. scalded milk
1 small onion — 2 T. butter
⅛ t. celery — 1 t. salt
1 T. flour — 2 t. chopped parsley

Simmer the onion and potatoes until soft in just enough salted water to cover. Make a white sauce of the flour, butter, salt, and one cup milk, then add the remaining milk and heat. Add cooked potatoes without draining. Cook 5 minutes and add the chopped parsley just before serving.

MILK TOAST I

3 c. scalded milk — 6 slices buttered toast

¾ t. salt

Add the salt to the milk and pour half of it over the toast. After the toast has taken up the milk, add the remainder. A few grains of nutmeg sprinkled over the milk toast adds a pleasing flavor.

MILK TOAST II

3 c. thin white sauce — 6 slices dry toast, buttered

When ready to serve, pour white sauce over toast arranged on a hot platter.

CREAMED EGGS

4 to 6 hard cooked eggs — 2 c. medium white sauce

6 slices toast

Chop or slice the eggs and add to the white sauce. Arrange toast on a hot platter and add the egg and white sauce. Two of the yolks may be kept out, rubbed through a strainer or potato slicer, and sprinkled over the top. Chopped parsley also makes an attractive garnish and gives a pleasing flavor.

Variations: Creamed eggs and potatoes, eggs and peas, eggs and ham, potatoes and ham.

CREAMED VEGETABLES

Any cooked vegetables may be used

Use ½ to 1 cup of medium white sauce to 2 cups of cooked vegetables.

The vegetables should be cooked in a small amount of boiling salted water until tender. Drain and add the hot white sauce . The vegetable water may be used in making the white sauce. This is a good way to use left-over vegetables. The following vegetables with white sauce are attractive and usually well liked: potatoes, carrots, peas, potatoes and carrots, peas and potatoes, carrots and peas, cabbage, onions, asparagus, celery.

CREAMED CHEESE

2 c. medium white sauce — Crisp wafers or toast

¼ lb. cheese, cut fine

Add cheese to white sauce and stir over very low fire until cheese is melted. Serve on crisp wafers or thin toast.

CABBAGE WITH CHEESE SAUCE

or

POTATOES WITH CHEESE SAUCE

Cut cabbage to medium fineness and cook until tender in boiling salted water. Place cabbage and cheese sauce (creamed cheese given above using half the amount of cheese) in alternate layers. Serve at once or cover top with buttered crumbs and brown in oven.

CREAMED MACARONI OR SPAGHETTI

2 c. spaghetti or 1½ c. macaroni broken into inch pieces

2 c. medium white sauce — ¼ lb. cheese

Cook macaroni or spaghetti in boiling salted water until tender. Drain and

pour 1 cup cold water through. Make white sauce, stir in cheese, cut fine, and heat till cheese is melted. Add cooked macaroni or spaghetti, and heat a few minutes together.

OTHER DISHES MADE WITH MILK

CORN CHOWDER

2 c. potato cubes
2 c. water
4 c. scalded milk
1 onion
1 t. salt
2 c. cooked green corn or canned corn
4 slices bacon
4 T. butter
Few grains pepper

Chop onion and bacon, add potatoes, salt, pepper, and butter and cook in water until the potatoes are soft, adding more water if needed. Add corn and 2 cups milk, then reheat to boiling point. Add remaining milk, heat, and serve.

ESCALLOPED POTATOES

Peel five or six medium sized potatoes. Slice thin and arrange the slices in a buttered baking dish in two layers, sprinkling each layer with flour. Add bits of butter, salt and pepper. Add milk until it comes to the top layer. Cover and bake in a moderate oven until the potatoes are almost done. Remove cover and brown.

For a change try putting between the layers of potatoes sliced bacon, a slice of smoked ham or a layer of canned beef, pork, or sausage.

CORN CUSTARD

2 c. corn (fresh or canned)
2 c. milk
3 eggs
1 t. salt

Beat eggs slightly, add all other ingredients, pour into a pan. Set in a pan of hot water. Bake in moderate oven until custard sets. When a dry knife inserted into the center comes out clean, the custard is done.

BREAD AND CHEESE CUSTARD

3 slices bread (cut in cubes)
½ to ¾ c. cheese (cut fine)
2 eggs
2 c. milk
1 t. salt

Put the buttered bread into a greased baking dish and then add cheese. Beat the eggs slightly, add salt and the milk. Pour this mixture over the bread and cheese. Set the baking dish in a pan of hot water. Bake in a moderate oven until custard is set and light brown on top.

COTTAGE CHEESE

COTTAGE CHEESE—JUNKET METHOD

1 gal. sweet skimmilk or whole milk
⅛ junket tablet
¼ c. cold water
1 c. sour milk (starter)

The sour milk should have a good flavor. Thoroughly mix the sweet milk with the sour milk, and warm the mixture to lukewarm by setting the container in a pan of hot water (test for lukewarm—a drop on the wrist feels neither warmer nor colder than the skin on the wrist). Remove from hot water and add to the milk the junket tablet which has been dissolved in cold water. Stir the mixture well. Cover with a cloth and let stand at room temperature (about 68° F.) overnight.

Pour the curd, breaking it as little as possible, into a moistened piece of double cheesecloth over a bowl. Drain it until it is free from whey, 20 to 30 minutes. Add salt and cream if desired.

COTTAGE CHEESE—SOUR MILK METHOD

1 gallon sour milk (use only fresh sour milk)

Break the curd into pieces about 2 inches square with long bladed knife to allow even heating. Heat curd to 100° F. (a little warmer than lukewarm) and stir the mass gently from time to time. Pour into a double cheesecloth and drain. The sides of the cloth may be raised and lowered every few minutes to hasten draining. When the curd is rather firm and dry, add salt, usually 1 to 2 teaspoons of salt to 1 gallon of milk. Cream may be added to improve the flavor and to soften.

Cottage cheese contains the proteins of the milk, therefore it may take the place of meat in a meal, especially in warm weather. When you have cottage cheese, make a plan for it in the meal.

A dish of cottage cheese may be made more attractive by garnishing with chopped parsley or bits of fruit, jam, or jelly. Cottage cheese may also be used with tomatoes, cucumbers, pineapple or pears in salads. It makes delicious sandwiches.

COTTAGE CHEESE AND TOMATO SALAD

3 c. cottage cheese
6 medium sized tomatoes
Lettuce leaves
Salad dressing

Peel tomatoes, take out core. Cut almost in half. Cut each half in three divisions, not cutting through on lower side. Open back. Arrange on lettuce leaves that have been washed thoroughly and drained. They may be shaken or patted between the folds of a clean cloth. Put a spoonful of cottage cheese in center of each tomato. Put spoonful of salad dressing if desired on top of each. Serve.

COTTAGE CHEESE AND CUCUMBER SALAD

1 c. diced cucumber
3 c. cottage cheese
Lettuce
Salad dressing

Mix cottage cheese with cucumber when ready to serve. Add salad dressing and serve on lettuce leaves. Garnish with sliced radish or chopped parsley.

PEAR SALAD WITH COTTAGE CHEESE DRESSING

Canned pears
Lettuce leaves
Cottage cheese dressing, (2 c. cottage cheese seasoned and softened with cream and salad dressing)

Drain juice from the pears. Arrange one or two halves of pear on leaves of lettuce. Place a spoonful of cottage cheese dressing on each plate. Garnish with a bit of jelly. Chopped nuts may be sprinkled over the salad if desired.

COTTAGE CHEESE SANDWICHES

Season cottage cheese with salt, add chopped parsley, nut meats cut fine, and moisten with cream or salad dressing till soft enough to spread. Butter thin slices of bread (rye, whole wheat, or brown bread is best), place lettuce leaf on one, spread other with cottage cheese, and press together.

Butter thin slices of brown bread. Put three or four together with cottage cheese between them. Slice across the layers, making "ribbon sandwiches" with four layers of brown and two of white.

BAKED CUSTARD

2 c. milk
2 eggs or 4 yolks
¼ c. sugar
Flavoring
Few grains salt

Beat the eggs, add sugar and salt. Add scalded milk to the mixture. Pour into individual cups or baking dish. Set cups or dish in pan of hot water and bake slowly until firm. The custard is done when a dry knife inserted into the center comes out clean.

Variations: Nutmeg, cinnamon, caramel, chocolate, raisins, dates, or cocoanut may be added. Marshmallows may be placed on top of the custard. Plain custard may be served with any kind of fruit, or with jelly or jam.

SOFT CUSTARD

Use same ingredients as for baked custard.

Beat eggs, add salt, sugar, and scalded milk. Cook over water, stirring constantly until the mixture coats the spoon. Then remove quickly from the fire. Place the pan in cold water to cool. Add flavoring. (In case the mixture starts to curdle, place pan immediately in cold water and beat with Dover egg beater.)

Variations: Nutmeg, cinnamon,caramel, chocolate, raisins, dates, or cocoanut may be added. Soft custard may be used as a sauce over fruits, cakes, puddings, or gelatin.

BLANC MANGE

Use recipe for soft custard, substituting 1 tablespoon of corn starch for each egg. Be sure to cook about 30 minutes in a double boiler or until the raw taste of starch has disappeared. The same variations may be made as for custard.

TAPIOCA CUSTARD

½ c. minute tapioca
3 c. milk
3 eggs
½ c. sugar
1 t. vanilla
Few grains salt

Scald the milk in a double boiler, add tapioca, and cook until tapioca is clear, stirring constantly. Cool slightly. Beat eggs, add salt and sugar, and pour slowly into slightly cooled mixture, stirring constantly. Cook until custard coats spoon, or turn into buttered mold and bake in oven in a pan of hot water until a knife inserted into center comes out clean. The egg whites may be reserved. When pudding is done, beat whites until stiff, add 1 tablespoon sugar to each white and drop by spoonfuls over top or spread over top. Bake until brown.

CREAMY RICE

4 T. rice
4 c. milk
4 T. sugar
Few grains salt
Flavoring (nutmeg, or vanilla, or cinnamon)

Place ingredients in double boiler or baking dish in the oven. Stir occasionally. Let cook from 3 to 4 hours. For chocolate creamy rice use a square of chocolate grated or 2 tablespoons in place of other flavorings.

JUNKET

1 qt. milk
2 T. water
4 T. sugar
Few grains salt
1 junket tablet
1 t. flavoring

Crush the tablets and dissolve in the water. Heat milk with sugar and salt until barely lukewarm (test for lukewarm—a drop on the wrist is the same temperature as the skin). Add dissolved junket tablet. Stir until evenly mixed. Turn into wet cups or molds. Chill and serve.

Note: Chopped nuts, jelly, or preserves, or powdered sugar mixed with cinnamon, may be added at time of serving.

Junket is good for all the family, and can be taken by small children and invalids.

QUEEN OF PUDDINGS

2 c. crumbs
1 qt. milk
1/3 c. sugar
Few grains salt
2 eggs
¼ t. nutmeg
½ c. raisins or currants

Soak crumbs in milk. Beat eggs. Add other ingredients and the soaked crumbs. Bake in buttered baking dish (about an hour) in slow oven. Test as for baked custard.

Variations: Save egg whites, and make a meringue as suggested in recipe for tapioca custard. Spread jam or jelly on baked pudding, then place meringue on top. For chocolate bread pudding, melt 2 ounces chocolate and add it with 1 teaspoon vanilla to pudding before baking. Serve with cream, or lemon sauce, made as follows:

Lemon Sauce

1 T flour
¼ c. sugar
1 T butter
1 c. boiling water
½ lemon juice and grated rind
A few grains of salt

Mix sugar, salt, and flour, add water slowly and boil 5 minutes, stirring constantly. When ready to serve, add butter and lemon.

FROZEN DESSERTS

MILK SHERBET

1 qt. milk or thin cream
½ c. lemon juice
1 c. sugar
Grated rind of 1 lemon

Mix lemon juice and sugar. Chill milk in the freezer, add lemon juice and sugar. Freeze. Part orange may be used if desired.

VANILLA ICE CREAM

2 c. scalded milk
1 T. flour
1 c. sugar
1 egg
⅛ t. salt
1 qt. thin cream
2 T. vanilla

Mix flour, sugar, and salt, add egg slightly beaten and milk gradually. Cook over hot water 20 minutes, stirring constantly at first. Should custard have curdled appearance, it will disappear in freezing. When cool, add cream and flavoring. Strain and freeze.

CHOCOLATE ICE CREAM

Melt two squares chocolate and add slowly hot custard from vanilla ice cream recipe. Cool and proceed as given for vanilla ice cream.

TWO DAYS' MEALS

IN WHICH A *CHILD CAN GET FOUR CUPS OF MILK AND AN ADULT TWO OR MORE

FIRST DAY

Breakfast	*Dinner*	*Supper*
Canned peaches	Meat pie	Cream of spinach soup
Whole wheat cereal and milk	Buttered beets	Crisp bacon
	Celery	Canned or sliced tomato
Soft cooked egg	Bread and butter	Baked potato
Muffins and butter	Chocolate creamy rice	Bread and butter
Milk	Milk	Apple sauce
Coffee—adults only		Milk
		Tea—adults

SECOND DAY

Orange	Baked ham with browned potatoes	Scrambled eggs
Cornmeal mush (with raisins if desired) and milk	Creamed carrots and peas	Scalloped potatoes
		Buttered green beans
Toast and butter	Lettuce salad	Bread and butter
Cocoa	Fruit roll with milk	Oatmeal cookies
Coffee—adults only	Milk	Raspberry milk blossom

* These meal plans, while suited to the family (including school children and adults) should be modified for the pre-school child under six years. For instance, the soft cooked egg is not needed at breakfast, and might replace the meat listed for the family dinner. The young child would not need meat. The fruit and vegetable served the family might need to be put through a coarse sieve, or cut fine or mashed, for the younger children. Salads, such as the lettuce salad, for the young child should not have salad dressing. A little weakened lemon juice or light cream dressing is preferable. Both cereal and a bread is probably more cereal food than the less active members of a family would need unless the portions are small. Both may be needed, however, by the growing boy and those working hard out-of-doors.

BULLETIN SUMMARY

1. Milk is a *protective food.* It excels all other protective foods, being approached in value only by fresh, green, leafy vegetables.

2. At least a pint of milk a day for each youth and adult and a quart a day for each child is a good standard.

3. Milk is relatively cheap on the farm. The farmer's family should use it more liberally in cooking and as a drink.

4. Milk, to be fit for human use, should be produced from healthy cows under sanitary conditions. It should be carefully handled until consumed.

5. Milk is the most excellent food known because it is a *complete* food.

6. Milk is indispensable for infants.

7. Children between the ages of 2 and 12 years are likely to suffer injury to health and strength if fed without milk.

8. Adults can *live* without milk. Health and vigor are improved, however, when the diet of every adult contains at least a pint of milk per day.

9. The liberal use of milk tends to maintain a sanitary condition in the digestive apparatus.

10. All things considered, milk is an economical food.

11. Milk used in cooking has the same food value as milk taken raw. Suggestions are made for the use of milk in various dishes prepared in the home.